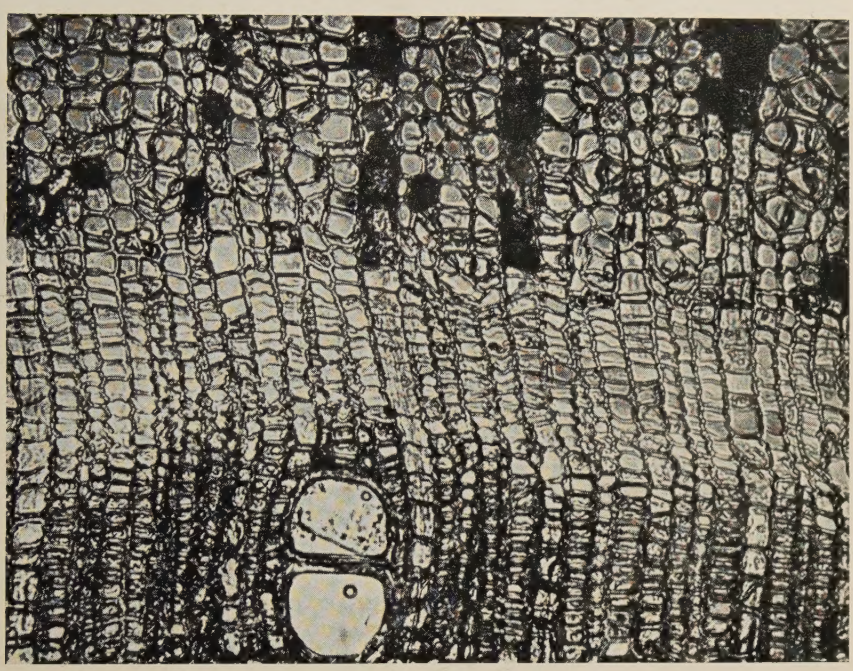
PLANTERS' BULLETIN

OF THE RUBBER RESEARCH INSTITUTE OF MALAYA



NEW SERIES NUMBER TWENTY

CONTENTS

	Page
Editorial: Fair Exchange	79
Dieback	80
Budgrafting Success	83
Hanging Gardens	89
Correspondence	92
Note	94

Price
50 Cents

September
1955

R R I

LOCATION. The institute's laboratories and offices are at the third mile, Ampang Road, Kuala Lumpur.

CORRESPONDENCE. All LETTERS must be addressed to the Director, Rubber Research Institute of Malaya, Post Office Box 150, Kuala Lumpur. Special inquiries may be marked for the attention of particular officers. The address for TELEGRAMS is Searching, Kuala Lumpur. TELEPHONE: Kuala Lumpur 3351. PARCELS occasionally arrive without any indication of their origin. Senders' names and addresses should be written clearly on the outside of all packages, and the institute should be advised of despatch by letter or telegram.

PROHIBITED PLANT SPECIMENS. Attention of planters and others in territories outside the Federation of Malaya and the Colony of Singapore is drawn to the Malayan Plant Importation Rules which prohibit the importation into Malaya of any part of a plant, whether living or dead, unless it is accompanied by a permit issued by the Director of Agriculture, Federation of Malaya. No permit will be issued in respect of any diseased plant or any plant pest. Any plant imported in contravention of these Rules (whose object is to prevent the introduction of diseases or pests) will be destroyed without examination. Anyone outside Malaya who desires our advice on any matter that may require examination of living material must first inquire by letter.

ADVICE. Inquiries are invited from rubber producers in the Federation of Malaya, the Colonies of Singapore and North Borneo, and the territories of Sarawak, Brunei and Nigeria, who may require more detailed information applicable to their own special problems. INTERVIEWS should be arranged by letter or telephone, as members of the senior research and advisory staff are frequently absent on visits to plantations. The institute is open from 8 am to 1 pm and 2 pm to 4 pm on Mondays to Fridays, and from 8 am to 12.30 pm on Saturdays.

EXPERIMENT STATION AND FACTORY. This station of the R R I is situated 16 miles from Kuala Lumpur, at Sungei Buloh on the Kuala Lumpur — Kepong — Kuala Selangor road. Visits may be made on Mondays or Wednesdays by arrangement. There is a guest house.

PUBLICATIONS. A list of 'Publications of the R.R.I.' is available on request. Subscription may be made by depositing $15 with us. An annual statement of account will then be submitted.

PLANTERS' BULLETIN

OF THE RUBBER RESEARCH INSTITUTE OF MALAYA

Kuala Lumpur September 1955 Number 20

Editorial: Fair Exchange

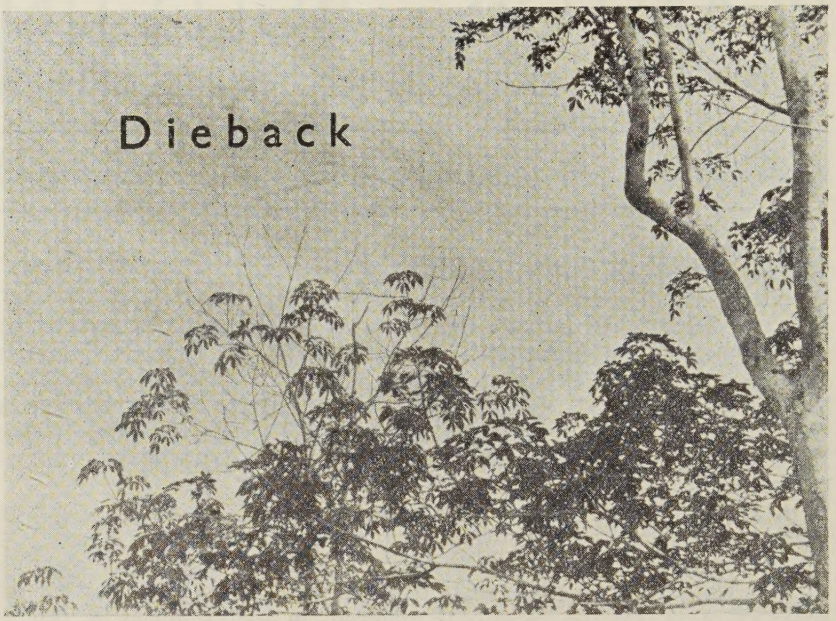
In our Editorial of January this year, the exchange of clones between the Rubber Research Institute of Malaya, and the Rubber Research Institute Ceylon, the Proefstation der Centrale Proefstations Vereniging, the Proefstation der A.V.R.O.S. and the Institut des Recherches sur le Caoutchouc en Indochine was mentioned. The eighty clones, twenty from each of the Institutes mentioned, are now growing at our Experiment Station.

In exchange, the Institute supplied twentyseven clones, from which the other research stations were each permitted to receive twenty. Of the twentyseven clones two are recommended for large scale planting in Malaya, one for medium scale planting, and twenty for experimental scale planting. Of the reciprocal material, in the countries of origin, three clones are recommended for large scale planting, thirteen for medium or small scale planting, and thirtythree for experimental scale planting. The remaining thirtyone clones are promising but not recommended.

The material therefore represents a most valuable addition to the planting material at present in Malaya, but its potentialities will not be fully exploited unless the material is placed as soon as possible under trial in this country to test its reactions under varying Malayan conditions and its suitability for planting. We have given much thought to this point, and we have evolved a plan which we hope will be acceptable to the Planting Community.

Our previous experience with the RRIM '500' series clones trials suggests that a more accurate, more easily supervised, and cheaper method of testing clones would be to employ a small number of specially designed large trials, rather than a large number of small and loosely linked trials. We would like to test all the exchange clones, together with some new selections to be added to the RRIM '600' series, some of the '600' series themselves, and three controls, a total of one hundred clones, in two replications of a simple lattice design on each site. Eight sites would be required, three on coastal soil and five on inland soil.

We anticipate that sufficient budwood will be available by the end of 1956 to establish all eight trials during that year. The land used should preferably be flat, and would be planted at a uniform stand of 22 feet by 11 feet. Such trials make a large demand on acreage, but in our experience should yield well. For the two replications eighty acres would be required on a good site, excluding irregularities, roads and ravines. If we can obtain the required sites, and the trials can be set up in 1956, budwood of the clones will be available for more general distribution in nucleus quantities during the ensuing year.



DIEBACK IS A SYMPTOM, NOT A DISEASE. The term is used for any condition in which the end of a branch or shoot dies and death extends downwards into originally healthy tissue. This condition is commonly induced by impeded nutrition due to poor soil, or a root system destroyed by disease. No dead plant tissue remains uninvaded by saprophytes for long and several species of fungus regularly appear in this situation. Sometimes these saprophytes are also weak parasites which can grow into living tissue and extend the dieback. In addition there are the true parasites, which can cause dieback in healthy plants. There are thus three categories of fungus that can be associated with dieback:

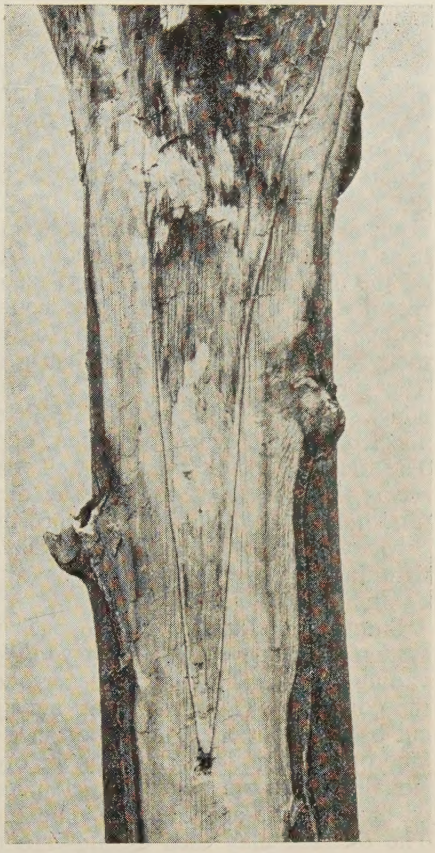
i invaders of dead tissue — saprophytes

ii invaders of dead tissue which, having gained access to the plant, grow into living cells — facultative parasites

iii fungi that invade a healthy branch — pathogens.

As the pathogen will always be followed by saprophytes it may be impossible to be sure whether damage has been caused by a pathogenic fungus, by injuries that have admitted a facultative saprophyte, or by some other cause that has affected the extremities. Dieback of unthrifty trees is common in Malayan rubber plantations (see title illustration), less often is it due to wounding or to a parasitic fungus.

Diebacks of non-parasitic origin — Dieback in which fungi or bacteria play no part (except in destroying wood that is already dead) is met with commonly in old rubber. Trees that have grown vigorously in their youth, and from which much latex has been taken, may have used up one or more of the available soil nutrients. This condition may be reached in younger trees if the soil is already deficient in some essential nutrient at the time of planting. It may be induced in trees of any age by a dearth or excess of water, which prevents absorption

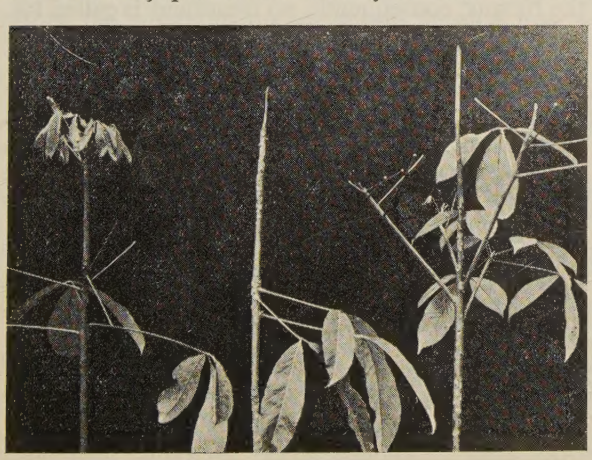


Diplodia dieback. The fungus has penetrated a wound (probably caused by sun scorch) and is invading healthy wood.

of nutrients that would otherwise be available. The extremities of the branches are the first parts to be deprived of food materials and die as a consequence. Leafless and dead branches project above the foliage like antlers from the head of a deer, giving rise to the foresters' term 'staghead'. Even plants only a few months old may respond to a nutrient shortage by suffering from tip death, followed by emergence of a new shoot below the dead tip. Iron deficiency may show up in this form at an early stage in the life of the plant.

The treatment for this type of dieback is to make good the nutrient deficiency, or to improve drainage if flooding or a high water table is the cause of the trouble.

Dieback caused by wound parasites — The wound parasite fungi gain access to the plant through freshly cut, broken, or scorched surfaces; they may follow fungi that have colonised dead tissue, or parasitic fungi that have infected a healthy plant. It is usually difficult to decide whether a fungus is confined to tissue that would have died in any case, is capable of extending into tissue that would not otherwise die, or is



Gloeosporium dieback. The green shoot has been attacked by the fungus Gloeosporium alborubrum and is dying back from this cause.

capable of actually initiating death of tissues. The most common wound parasite fungi are a species of *Colletotrichum* and a species of *Phyllosticta,* which are usually intimately associated. A third fungus, *Botryodiplodia theobromae.* almost invariably follows the *Colletotrichum* and *Phyllosticta.* For long it was considered to be the primary cause of 'diplodia dieback', a disease to which it gives its name and which occurs in various forms. Typically the branches of three to four year old trees are affected and die progressively from the tips. When the branches are split open, the infected tissue is seen as dark blue or black lines running through the wood. Gum barriers – which sometimes cut off the infection altogether – may also be seen. A 'diplodia dieback' that recently has been causing some concern appears to be associated with drought conditions at the time of wintering. Different clones vary in their response and it is particularly common on Gl 1 and RRIM 512. The symptoms as seen from the ground are dead branches to which cling shrivelled petioles, the leaflets having fallen individually. The affected branch, when cut open, commonly shows one-sided wounds. The dieback occurs even on well manured and cultivated plantings; it seems that the fresh green tissue dies from water shortage and *Colletotrichum and Phyllosticta* at once invade.

Many cases of so called diplodia dieback are now recognised to be lightning damage — the fungus rapidly colonises wood scorched by lightning.

Stumped buddings may die back if dry conditions prevent the root system from developing. *Botryodiplodia* is prominent among the invading fungi and is apt to be erroneously regarded as responsible for the condition. The same fungi may infect the snag of buddings newly cut back, a matter of no importance so long as the stock is sufficiently vigorous to limit the infection before it reaches the bud patch. Occasionally it happens that the scion has developed into a shoot an inch or more in diameter by the time the snag has died back to its base. The dieback may then extend into the scion and grow upwards, gradually narrowing as it enters healthy tissue. The general appearance of this wound, with broad base tapering to a narrow apex, is descriptively called 'spearhead dieback'. The shape shows that the healthy tissues are able to resist the fungus, consequently no treatment is called for.

Other fungi besides *Botryodiplodia, Colletotrichum* and *Phyllosticta* may act as wound parasites, particularly when large branches of mature trees are involved. Some have bracket fruit bodies like the major root disease fungi and are then readily recognised, but more often the branches die without any external sign of the cause. A species found on a number of occasions is *Trametes incana.* Sometimes the fungus is delimited by its host in the same way as with spearhead dieback, one segment of the branch being dead and the rest alive.

Treatment of a fungal dieback consists of pruning down to healthy tissue (which can be taken at 12 to 18 inches below the apparent limit of invasion) and afterwards treating the exposed surface with a fungicidal wound dressing such as coal tar (*Planters' Bulletin 17,* page 27).

Dieback entirely fungal in origin — In Malaya only one dieback of hevea is known to be caused by a fungus invading an otherwise healthy stem. This is *'Gloeosporium* dieback', for which the fungus responsible is *Gloeosporium alborubrum,* well known as the cause of

Gloeosporium leaf disease. Associated with this fungus in the dying back stem are the same *Colletotrichum* and *Phyllosticta* that are found as the precursors of diplodia dieback. The relationship of these fungi to *Gloeosporium* is not yet clear, but they are mentioned because their names have been used in the literature to designate this dieback. The symptoms of attack typically appear first at the level of the penultimate flush, though it is believed that the fungus penetrates at the leaf bases of a terminal flush, the buds developing into another flush before the effects show. The green stems turn brown at the point of penetration and pink pustules of *Gloeosporium* may be visible on the surface after a few days of wet weather. Once the stem is encircled the tip dies back rapidly, followed by the whole shoot as the fungus grows downward. In young seedlings the fungus almost invariably gets checked, a number of axillary buds develop below the point at which it stops, and the plant recovers. *Gloeosporium* dieback is most serious in young buddings because if the fungus grows back to the bud patch the whole plant will be killed. A similar type of attack may occur on shoots of mature trees but is of negligible importance.

A pathogen and a wound parasite, once having reached healthy tissue, must be treated in the same way—by cutting out. Dieback in valuable material can be prevented by treating wounds to stop wound parasites entering, and by spraying with a copper fungicide to control attack by fungi that are truly parasitic.

Budgrafting Success

THE SUCCESS OF BUDDING VARIES. Failures waste valuable budwood and delay the field programme. A review of the process may assist the planter to discover the cause of poor success.

The central woody tissues of a tree and its branches are surrounded by a cylinder of dividing cells known as the cambium (*Figure 1*). When actively dividing these cells have very thin walls. The cells formed from the cambium on the inside develop into new woody tissues and those on the outside form new phloem or bast tissues, including latex vessels. By this process the tree increases in girth and in later life the bark renews after tapping. The word bark will be used here to denote all the tissues outside the cambium, although this is not quite accurate botanically.

When the bark is peeled away from the stem the line of cleavage between bark and wood occurs in the cambium, because the thin walled actively dividing cells are the weakest. Not all the cambial cells are destroyed by this action; a thin layer, still actively growing into wood or bark tissues, remains undamaged on each of the exposed surfaces.

When the cambium is inactive, the bark tissues cannot easily be stripped away without excessive damage, and insufficient dividing cells remain to form the layers necessary for regeneration. In budgrafting, the cambium of the scion (i.e. the budslip) is placed in contact with that of the stock. If both remain active they grow together to form one new cambium. Thus conditions must favour cambial activity at

the time of preparation of the stock and budslip, and afterwards to enable the tissues to grow together. The activity of the cambium is stimulated by complex growth promoting substances descending from the leaves. These natural hormones also inhibit the outgrowth of lateral buds. Their supply is inadequate when the leaves are lost or diseased, during wintering, and in the first stages of the outgrowth of new flushes. When the stocks are cut back the supply of hormones is removed.

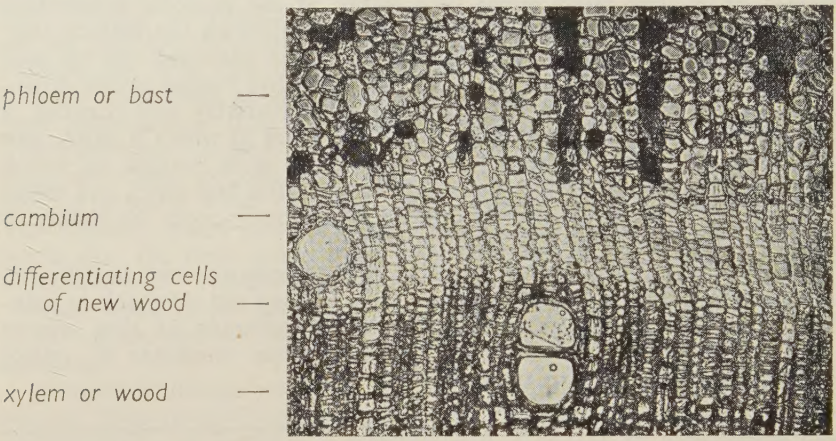


Figure 1. A microphotograph showing the tissues of a rubber tree in section

Care should therefore be taken to avoid budding when stocks or budwood are not in a condition of steady, vigorous growth. Optimum conditions for growth usually occur in Malaya during the periods of August to January and March to April; these are as rule the best seasons for budding. When budwood is taken from old nurseries or from the branches of mature trees, the wintering season must be avoided. Many new flushes may be expected after manuring, so fertilisers should not be applied less than four months before stocks and budwood are required. Ideally, stocks and budwood should be in a like state of healthy growth. Clearly the best time for budding is when rain may be expected to ensure vigorous growth. But budding during rain or when dew and mist still cling to the trees must be avoided, chiefly because it is difficult to ensure the required degree of cleanliness for success.

Budwood — Most budders achieve higher successes using budwood with brown bark, not green. Easy stripping is a sure sign of cambial activity.

The budwood after cutting should have the ends waxed unless it is to be used the same day. It must be protected from the sun and mechanical damage. The sticks must not rub against each other for this might damage the delicate buds. Damp sacking with grass or cover crop forms a suitable temporary packing, but for long distance transport the sticks should be wound in coconut fibre just damp to the touch and carefully packed in sacking or boxes.

Stocks — These should be at least one inch in diameter at 4 inches from the collar. When buddings are intended for transplanting as budded stumps (see *Planters' Bulletin 6**, page 50) stocks of 2 inches or more in diameter often survive better in adverse conditions, although smaller stocks are cheaper to pull and transplant. The larger the stocks, in general, the longer the dormant period after cutting back but the more rapid the growth of the budshoot when it does come away.

Procedure — Although budgrafting technique is well known, particular points merit more attention. Cleanliness is essential throughout. Budders should not be allowed to cut and keep in their working boxes a large number of budslips for several hours' work since these may get dry. After cutting the budslips the procedure is to:

1 clean the base of the stock with rough cloth or sacking;

2 prepare the stock on the shade side (the north and south sides are protected by the leaves when the sun is overhead and do not face the morning and afternoon rays) — make the three cuts necessary to open a flap of bark about 4 in × $\frac{3}{4}$ in (this should not be opened immediately);

3 trim the budslip, remove the wood from the bark and cut the slip to fit the panel so as to leave a narrow margin of about $\frac{1}{8}$ inch wide at the edges and $\frac{1}{2}$ to $\frac{3}{4}$ inch at the top;

4 open the flap on the stock and insert the budslip;

5 close the flap and bind the whole together with a bandage, or with a palm frond slip and twine;

6 fix a leaf as a shade.

A good budder may make the flap free to open upwards or downwards, whichever is swifter and easier. A flap with the free end below helps to keep rain out but the exclusion of water should be ensured by adequate covering and firm binding.

Although the stock is marked out first, it is not opened at once. This procedure allows the exuding latex to partially coagulate, and reduces the risk of a smear or trickle of latex covering the exposed cambium and preventing union. If the budslip were trimmed and stripped first, it would be left exposed for a few moments. Then dirt particles might settle on the cambium surface and worse, the delicate dividing cells might be damaged by exposure to dry air or sunlight. We therefore recommend making the flap cuts first and dealing with the budslip second.

When the budslip is stripped the wood must be bent away from the bark and not the bark from the wood. If the budslip is cut too thick the woody portion will not bend away easily. The object is to keep the bark in as near its natural position as possible. This is most easily achieved by holding the trimmed budslip by the top and edges and pulling the wood away with the teeth (*Figure 2*). The wood may be bent away with a knife, but this requires more care and is likely to damage slips with prominent buds. Any bending or cracking of the bark increases the damage to the cambial layer, and latex will seep onto the cambium surface. Latex may also seep from bruised budwood.

* *Out of stock, but a reprint of the article 'Stump Planting' is available.*

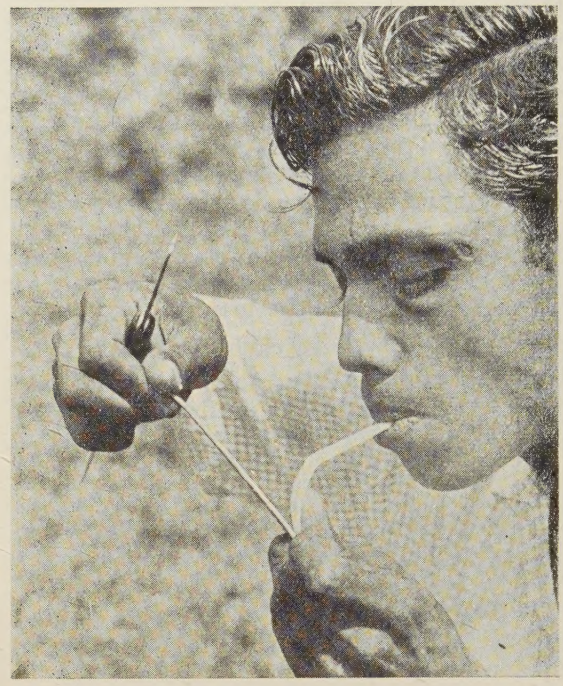


Figure 2. Stripping the wood away from the bark of the budslip. Note how the bark is kept straight.

Before the budslip is inserted it should be inspected to see that the bud is still undamaged and that the cambial cushion on the inner side is not broken.

During insertion of the budpatch and binding of the budding, the two cambial layers must not be rubbed together or the dividing cells will be torn. The two surfaces should be placed together and kept firmly in contact without any lateral movement whatsoever. The budslip should be the right way up, with the leaf scar below the bud. An upside-down budslip will take, but the final union may be unsatisfactory becauses the scion shoot twists, loops or turns sharply at the union.

After the budslip has been inserted the flap is closed over it and the whole bandaged and bound. A waxed calico bandage (about 24 in × $1\frac{1}{4}$ in) is the traditional material. This should be wound tightly from below upwards, and the free end pressed into the bark of the stock with the bone end of a budding knife. Bandages may be used more than once, but their value deteriorates. Apart from the high cost of waxed calico bandages, they have other disadvantages. If not in good condition they break when pulled tight, and unskilled workers are apt not to fix the free ends properly. With large stocks the bandages may be inadequate to cover the budding flap completely and as a result rain may enter.

We recommend instead the use of covering shields cut from mature leaflets of coconut palm. These should be about 6 in × 2 in, with the main vein central. When placed over the closed flap the shield should overlap on all sides. Hessian twine is tightly bound round the budding itself, and above and below to seal it against the entry of rain. Firm binding, maintaining a steady pressure during the whole operation, is absolutely essential. Palm leaf shields give slightly lower success than the best that can be achieved with waxed bandages.

When budding is done in the field or on the exposed edges of nursery beds a leaf shade must be affixed after binding, for protection against the sun.

Opening — The period before opening must be adequate for the tissues to grow together, but not so long that the stock increases in girth and causes the binding to bruise the budpatch. Girthing accelerates in wet weather and is relatively greater for smaller stocks. Nursery buddings are opened earlier than field buddings. The period between budding and opening may be from 14 to 23 days but in normal field practice 18 to 20 days is the optimum. For example, if the period after budding has been very wet, nursery buddings may be opened after 14 days and field buddings after 16 days. Field buddings on normal stocks may be opened after 23 days.

On opening the flap is cut horizontally along the clearly defined ridge which marks the upper edge of the patch beneath the covering flap of stock bark. Any callus around and over the budpatch should be removed. The brown bark of the exposed patch is slightly scraped near the top and below the 'eye' or dormant bud — if the healthy green of living inner bark shows, the budding is a 'success on opening'. There is no need to cut a deep nick into the budslip, a light scratch suffices to expose the green inner bark. In the field it is especially important to renew the shade over the budpatch after exposure.

Figure 3. A successful budding ready to be cut back. Note that the scar is below the bud.

Cutting Back – The period between opening and cutting back is to enable the union of cambial layers to complete and for the budpatch to harden off in its new environment. Stocks should not be cut back for at least ten days after opening.

The stock should be sawn off about 4 to 6 inches above the bud, depending on the size of the stock. For larger stocks at least 6 inches of snag should be left or the snag may crack and split due to direct exposure to the sun. The remaining snag normally dries and rots away; wounds heal without difficulty on stocks up to 2 inches in diameter. With larger stocks the remainder of the snag may have to be sawn off when the budshoot has a foot or more of brown bark above the union. The snag should be sawn off at an angle of 45°, the upper end of the

cut being just above the budded shoot and the lower end below on the other side. The edges must be trimmed to promote even callus growth. A wound dressing, such as a mixture of cow dung and clay applied on a piece of hessian, prevents dieback from destroying the budding and aids healing. Painting the cut surface with a good white lead paint mixed with linseed (not mineral) oil is also satisfactory.

When buddings are not cut back the stocks continue to girth, especially during rainy periods. In such circumstances the budpatch may be lifted away from the stock. This occurs when callus growing from the edges of the flap makes a pincer movement on the budpatch; distortion is also due to the less vigorous growth of the regenerated cambium beneath, compared with the original stock. Although successful buddings which have not been cut back may survive six months or more during a dry spell while awaiting transplanting, for preference they should be cut back within a month of opening, if conditions are favourable.

Aftercare — The young buddings must be regularly inspected and stock shoots pruned away to ensure that only the grafted bud grows out. When the grafted bud grows out, a vascular connection forms through the regenerated cambium of the union. Growth reorientates about this new axis, so that wood and bark tissues formed after the union are continuous from stock to scion. During the first stages of this process the union is weak because the new wood tissues are not yet hardened in a saucer shaped area at the base of the young shoot.

At one time young buddings used to be protected with shields split from large bamboo stems. This is rarely done in the field now but is worth while when valuable material is being multiplied in the nursery. The shade from the shield helps to turn the young budding upward and also protects the young shoot from insect attack, particularly by grasshoppers which can cause considerable damage by nibbling the tender growing points of newly emerging budshoots.

In closely planted nurseries all successes should be cut back together and unwanted seedlings removed. Otherwise the shade of the grown plants suppresses the young buddings, and rainwater dripping from the leaves encourages dieback of the young shoots, due to fungal attack.

SUMMARY

The main points are the selection of budwood and stocks which strip easily; cleanliness in all budding operations; care in avoiding bruising, bending and drying out of the bark, from cutting of budwood to insertion of budslip. Success depends on the activity of the cambium. The delicate cells have to be protected. Latex, dirt or moisture must be prevented from separating the tissues of stock and scion. The period before opening needs to be adequate for a union to be formed, but not long enough for girthing to cause undue pressure on the budding. This must be judged on weather conditions.

Finally, the successful budder is usually born, not made. Good hands work fast and surely at critical points in the operation; absolute cleanliness is only perfected by practice. Any member of the gang who fails to measure up to these standards will prove an expensive liability.

The common nest fern Asplenium nidus.

Hanging Gardens

OFTEN THE MONOTONY OF A rubber plantation is broken by other plants growing on the branches. Despite their picturesque value, these vascular parasites and epiphytes have undesirable effects, which may be prevented from becoming serious without great expense if tackled early.

Parasites — A parasite draws its nutrients directly from the living tissues of another organism. A total parasite obtains all its food in this manner but a partial parasite does not depend upon its host for all its requirements. The flowering plants which parasitise hevea in Malaya are all partial parasites of the mistletoe family (Loranthaceae). A species, *Viscum orientale,* similar to the European mistletoe, is occasionally found on rubber trees. The two species commonly found are *Loranthus globosus* and *L. pentandrus.* The former has opposite leaves and the latter has alternate leaves.

The sticky seeds are distributed by flower pecker birds. The seeds germinate almost anywhere, but a plant will only survive if the root penetrates the bark of a suitable host. The root grows down to the cambium and young wood. Often the mistletoe root grows round inside the host's tissues to form a ring tapping the whole vascular supply of the branch. The host responds by producing callus over the invading root, which in turn encircles the branch again. A mass

Malayan mistletoe on a rubber tree. The lumps of callus mark where the parasite is attached to the branches, of which the extremities have died

Drynaria rigidula encircling a trunk. The long leaves are green, but the short leaves close to the trunk are brown.

of tissue results, but the host loses in this struggle and the part of the branch beyond the parasite's attack is deprived of water and dies. The Malayan mistletoes send runners back along the host branch and invade the tree again.

Mistletoes are evergreen and easily seen when the rubber is wintering. Attacked branches should be sawn off, making sure that none of the suckers remains. If mistletoe is removed when first seen, it rarely does much damage. But undisturbed, the seeds of a few plants are rapidly distributed by birds and many branches, even whole crowns, may be lost.

Epiphytes – An epiphyte uses another plant as a support but does not feed upon it, nor is the epiphyte connected with the ground. Where it rests, the bark of the tree may rot and supply some nutrients. Many epiphytes entrap old leaves and debris, which form a mass of peaty soil. The young fronds of the common nest fern first grow upwards through the lodged matter and then bend outwards, enmeshing the debris between the leaf bases. Other plants thrive in these aerial gardens, even tree seedlings.

Drynaria has an interesting form. From a stout root stock two sorts of leaf arise, green foliage fronds and short brown leaves. The latter are shaped like scallop shells or cupped hands and aid in retaining falling debris and moisture.

Drynaria sparsisora climbing up the forked trunk.

Platycerium coronarium the stag's horn fern.

One species grows round the tree like a nest fern, the other two Malayan species grow up and down the trunk. The stag's horn fern is familiar to most. The mass of material gathered is so heavy that when this fern grows on the fork of a lateral branch, the weight finally breaks the branch. There are several other species of fern that grow on rubber trees. Some with thick fleshy leaves, some with delicate leaves which only grow in association with other ferns that have already accumulated a mass of moist material.

The most common flowering plants found on rubber trees are species of *Dischidia*, the pigeon orchid and *Ficus annulata*. The last is one of the strangling figs. The habit of this group is to start life as an epiphyte but later to send down roots which eventually enclose the tree in a network of trunklike organs. The original host is strangled to death by their pressure and smothered by the fig crown which develops in the light by standing on its host's shoulders. However, *Ficus annulata* is the only common strangler on hevea in Malaya and it rarely kills. No case is known of a rubber tree being strangled in this manner but the process takes a long time — perhaps a century — and rubber has not been here long enough. Cases may exist in abandoned rubber.

Dischidia gaudichaudii creeping down the tapping panel. A pigeon orchid (Dendrobium crumenatum) is seen upper left and the end of a Drynaria quercifolia rhizome and leaf is on the upper right hand side.

Epiphytes have the following undesirable effects. The breaking of

branches has been mentioned. The masses of wet humus collected and formed by epiphytes encourage rotting. Often a branch is found to have died back immediately above a large epiphyte. Although epiphytes are adapted to retain a mass of water the excess trickles down the trunk long after rain has passed. Moreover the water is often channelled into streams, so that parts of the tapping panel may be kept wet for long periods, encouraging precoagulation and disorders such as mouldy rot. The bark under an epiphyte is always damaged and uneven. Their encroachment onto the panel, or a possible future ladder tapping panel, engenders difficulties later.

It might be added that mosquitoes breed in the water held by stag's horn ferns.

The severity of these disadvantages is only pronounced where epiphytes have been allowed to remain for many years. Therefore it is adisable to push off the epiphytes with a long pole when they first appear, especially on valuable young rubber.

Correspondence

The Editor invites the offer of brief letters for publication. Comment and queries arising from articles in PLANTERS' BULLETIN *are welcome. The name and address of the writer must be given in full, but may be withheld from publication.*

o

CLONAL SEED

We should welcome your views on the contention that the second generation from clonal seed is no better than unselected material.

Oriental Estates Agency Group

H.E. Cowper

Assistant General Manager

For practical purposes this contention is true, although the effects of selection remain to a slight degree even in the second generation. Statistical investigation has shown us that yields of second generation seed are lower than those of the first generation (known as 'clonal seed').

Clonal seed are obtained from pollination in a seed garden. The crossed progeny are intermediate between the parent clones, and show a fair amount of variability. Their latent variability is much greater, however, and includes recessive characters which do not appear until the second generation.—Editor

o

DAMAGE BY BATS

I read with interest Mr Sandison's letter on page 56 of *Planters' Bulletin 18*. This damage has been known for many years in Ceylon and, to my knowledge, is confined to leaves of Gl 1. This clone is singled out even when planted in small areas (5 acres) among many others.

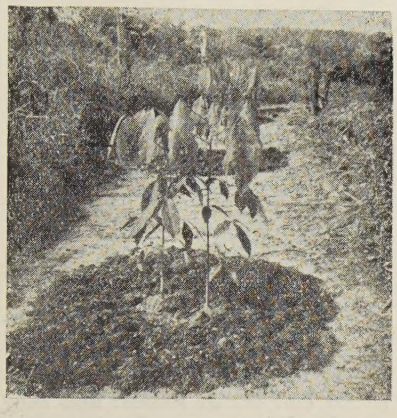
My note in *Rubber Research Scheme (Ceylon) Quarterly Circulars* 22 (1945) 39 explains how the attack can be met successfully by using nets.

Mirishena Estate, Ceylon

E.C.K. Minor

Superintendent

MULCHING AND MANURING



The photograph shows illegitimate Tjir 1 clonal seedlings, average height 3 ft 6 in at 3 months. They were planted as germinated seed at stake, with 4 oz per point of a mixture of 87½% Christmas Island rock phosphate and 12½% Fritted Trace Elements. The latter preparation (available from Imperial Chemical Industries Ltd) contains the important trace elements, iron, copper, zinc, manganese, boron and molybdenum in slowly soluble form. The mulch is waste fibre from the Highlands palm oil factory, weathered in the open for 3 weeks before use.

After 5 years experimenting I am convinced that the benefits from this partial mulching are considerable during the first 3 years of growth; thereafter the effect is less pronounced.

Full mulching to the 'drip circle' for maximum effect—is not practical on a rubber estate.

K. Brown

Midlands Estate

This vigorous growth need not be due to the Fritted Trace Elements used. Malayan soils generally show no evidence of deficiency in essential trace elements. Iron and manganese deficiencies occur in occasional small areas; copper and zinc deficiencies have been observed experimentally but not on estates; young rubber can grow well without boron for several months; symptoms of molybdenum deficiency have not yet been recognised in rubber.

The planter could spend money needlessly on applying the mixture of trace elements to a soil probably deficient in none. Small scale trials are worth considering.—Editor

o

MECHANICAL SPRAYING

The Ferguson tractor with Allman attachment is admirable for road work, but for spraying weeds between rubber trees the boom is not always convenient. A modification which has proved itself in a flat planting with 40 feet between rows, is to substitute two spray lances on 20 foot hoses for the boom. Using these accessories from an Allen scythe spray pump, 80 gallons of solution were sprayed per acre.

The photograph shows one of the lance men filling the 40 gallon tank from a drain; the portable petrol pump is attended by the hose man. The second

lance man stands by to add the stock solution of arsenic – ½ gallon of 10 lb/gal solution for a 10 lb/acre application – to which Teepol has been added. A raised reserve drum (44 gallon) provides against breakdown of the pump, and can be left in the field, as no arsenic is added to it.

One filling sprays half an acre in 20 minutes. The fourth man is needed in rough conditions to clear the hoses from snags, and to shout to the driver when to stop. When the tank empties, the hoses and lances are left to mark the spot, while the spraying team rides back quickly to the refilling point. Suitable hose connectors tighten by hand, and have internal taper or washers to minimise leaking. Valuable time is lost unless the refilling technique is reduced to a drill. Three minutes should be enough for this.

Suffolk Estate
N.S. Maccoll
Manager

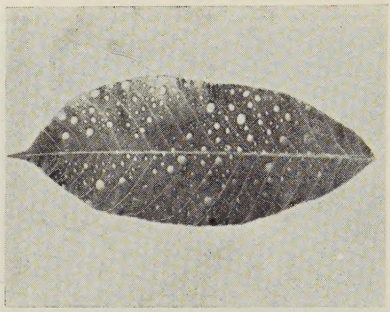
o

RAINDROP LENSES

The leaf enclosed is from a six months Tjir 1 seedling. Raindrops from a shower during the night were still on it when it was picked at 9 a.m. The sun appears to have scorched the leaf through the raindrops acting as lenses. The lighter marks towards the edge were dry but the darker ones near the midrib had drops still adhering.

I wonder whether this might not be the cause of some of the so called leaf diseases on young rubber, e.g. bird's eye spot.

Sungei Kahang Estate
G.M. Rothwell
Assistant Manager



We have photographed this interesting specimen which demonstrates excellently how water drops can act as lenses, and how quickly the sun can bleach green tissue. One can imagine that the leaf could be found and interpreted as suffering from a leaf spotting disease, particularly after a few days when saprophytic fungi would have invaded the dead tissue.

The microscope can always show whether a fungus present caused infection or merely invaded tissue dead from another cause. Bird's eye spot can initiate infection—when spores are placed on a young leaf, a lesion is seen to develop around each. This spot formation is illustrated in our Journal (Communication 280).—Editor

Thinning and 2,4,5-T

Thinning experiments, using a tree poison based on 2,4,5-T, suggest a risk of casualties among the trees not treated. This effect may show as late as two or three months after application, and is probably due to rootgrafts.

We therefore advise caution in using 2,4,5-T for thinning dense stands of young trees. The liquid should never be spilt on the ground.

Identification of Clones

The services of our skilled budding mandors are available to estates for clonal identification of budwood in multiplication nurseries. These mandors do not identify clones in large scale planted areas, except to confirm the identity of a few trees so that branch budwood may be taken. No opinion can be given on the origin of seedling trees.

The charge for this service has been revised, and conditions are:

i The estate pays $20 a day for the senior mandor, or $10 a day for a junior mandor. This charge represents wages.

ii The estate pays travelling expenses.

iii The estate provides accommodation and food for the mandor, or a subsistence allowance of $7 a day.

iv Whilst our mandors are reliable and experienced, we give no guarantee and accept no liability for mistakes.

Applications should be addressed formally to the Director and two or three months' notice should be given if possible, stating the latest practicable date and the extent of the work. Further particulars on request.

Mature budded trees are best identified from their seed. Ripe seed, gathered directly from the parent trees, may be sent to us for checking against type samples.

Exchange Clones

Any organisation which is interested in cooperating with the Institute to test these clones is asked to write to the Director, who will be pleased to forward further details concerning the proposed trials.

RRIM '600' Series Clones

It is the policy of the Institute to supply only nucleus quantities of budwood for multiplication, but owing to a large and unexpected demand for the above clones during 1955, we regret that we have been obliged to disappoint in part a number of applicants for budwood. Steps have been taken since January this year to increase considerably our budwood multiplication nurseries.

Budwood of the RRIM '600' series clones should be in better supply early in 1956 and more freely available at the end of 1956.

All orders should be placed direct with the Manager, Rubber Research Institute Experiment Station, Sungei Buloh, Selangor, (telephone Kepong 220).

OUR COVER ILLUSTRATION IS A MICROPHOTOGRAPH SHOWING THE TISSUES OF A RUBBER TREE IN SECTION

See page 83

Printed for the Board of the Rubber Research Institute of Malaya by
The Standard Engravers & Art Printers, 51 Campbell Road, Kuala Lumpur
Selangor